SBE status report

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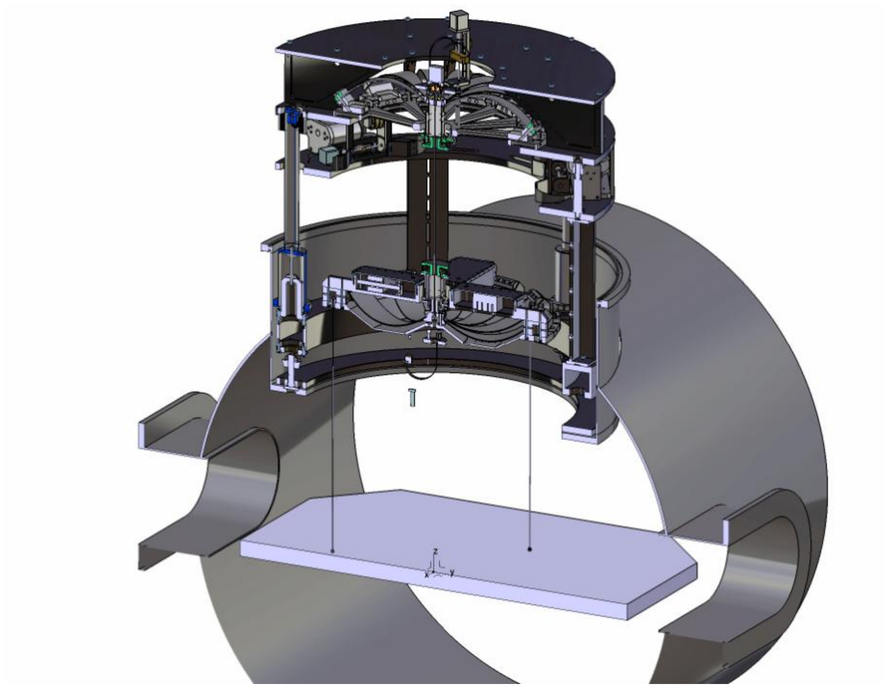
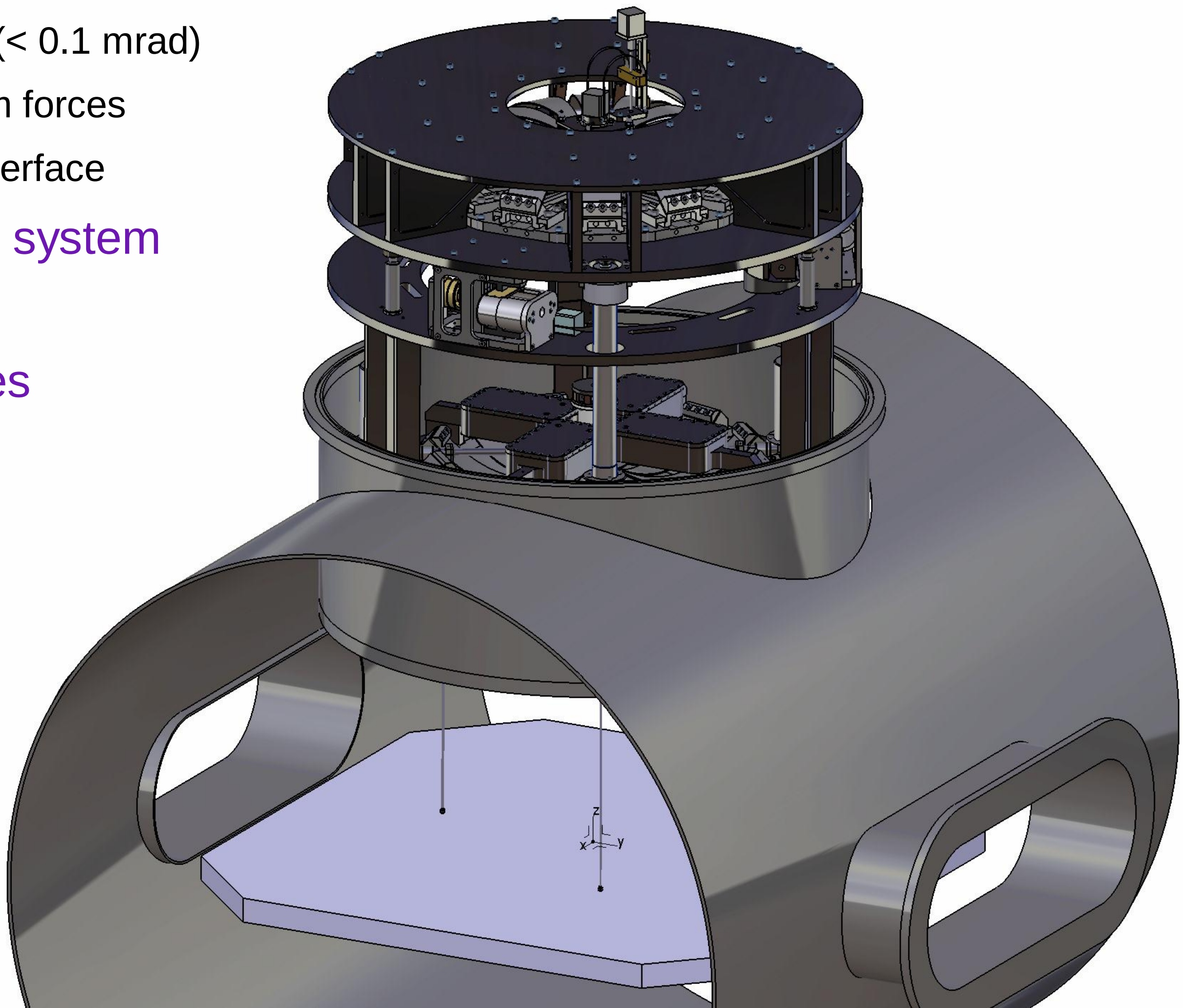


Introduction

- Introduction
  - General considerations
  - Design issues
- Status of project
  - SAS mechanics
  - Sensors
- Schedule
  - Prototype
  - Time line

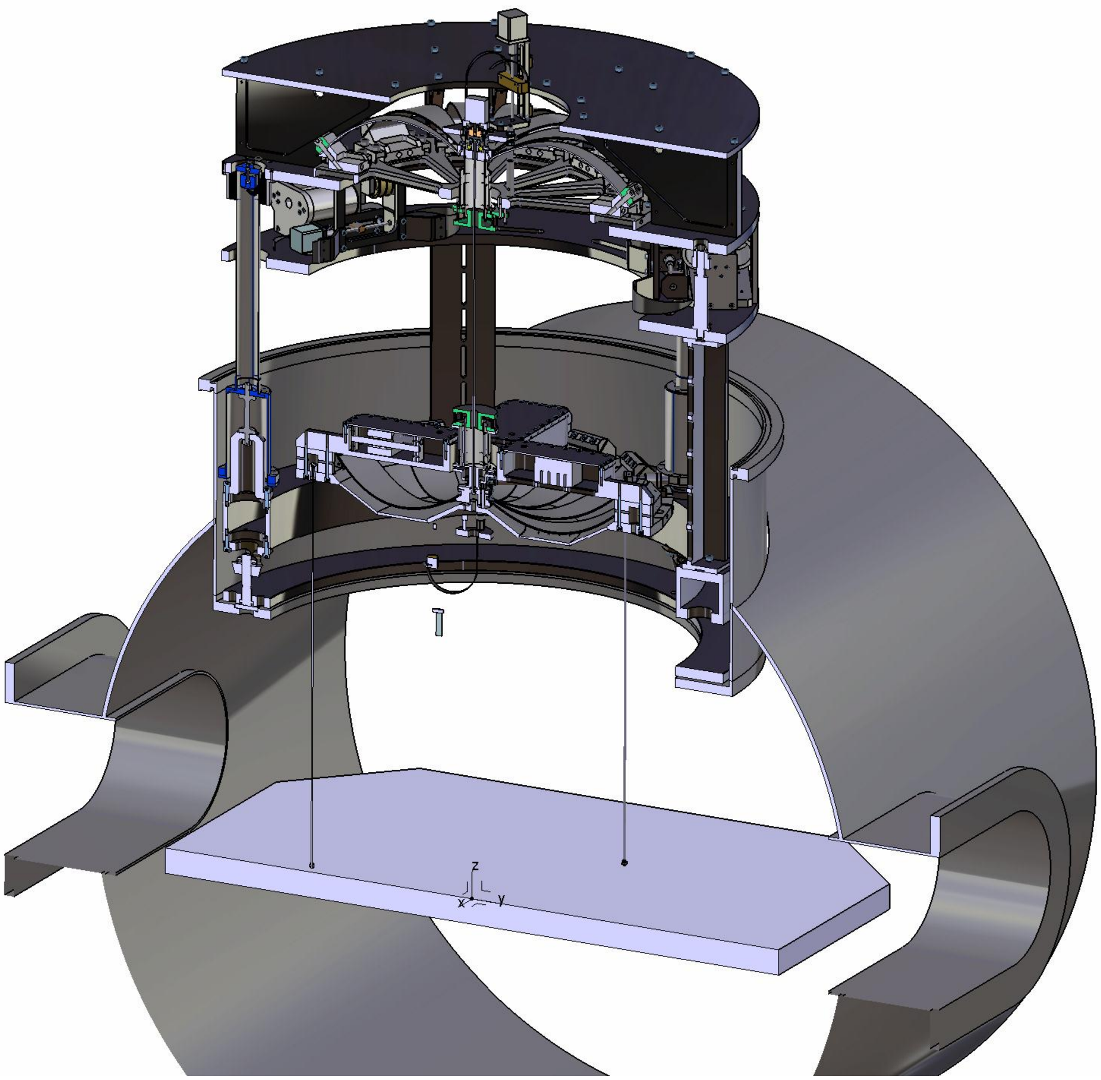
Mini-tower interface

- IP support structure
  - Tilt stability (< 0.1 mrad)
  - FEA vacuum forces
  - Agree on interface
- Clean-air flow system
  - Integration
- Vacuum issues
  - Materials
  - Procedures

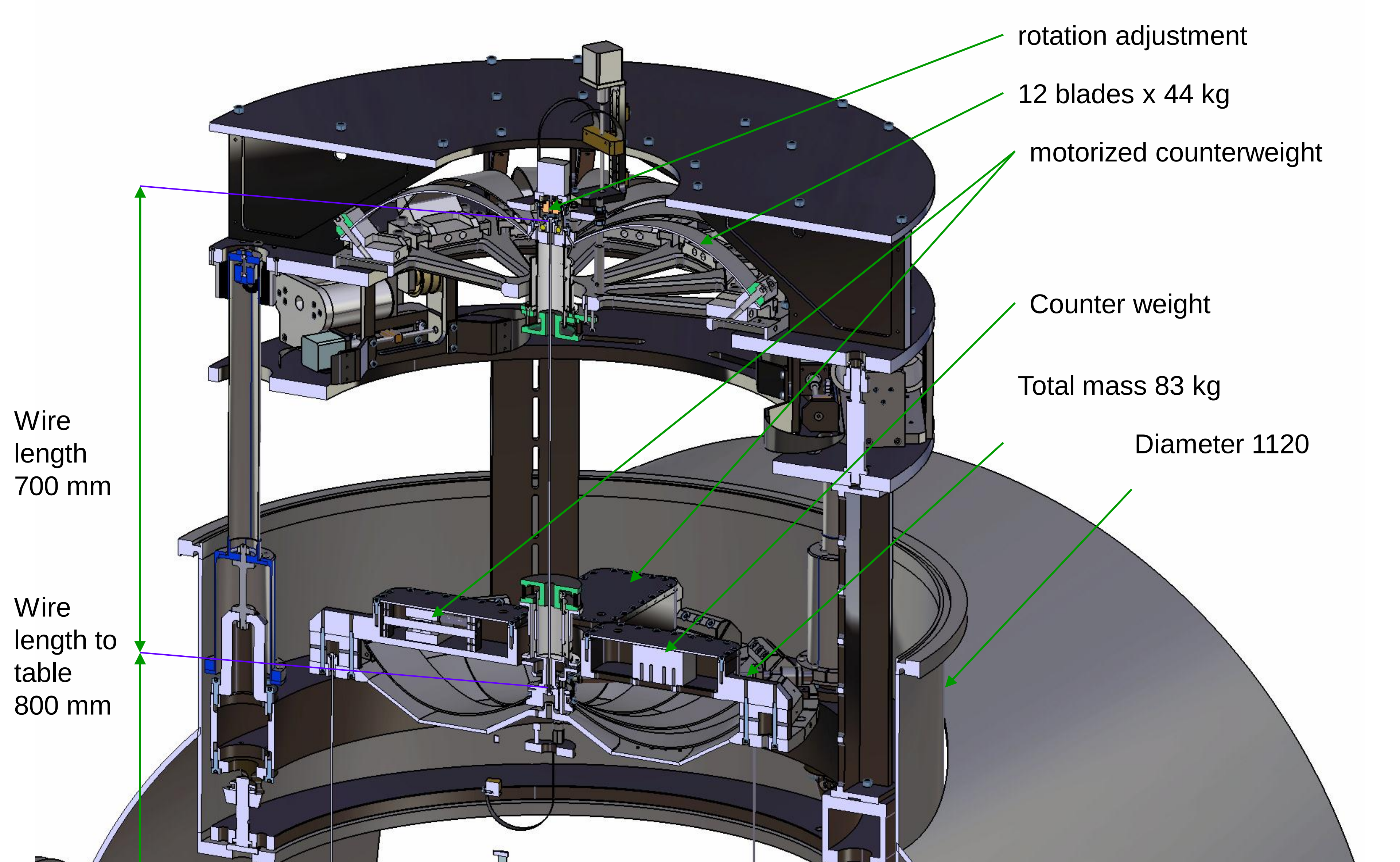


Overview

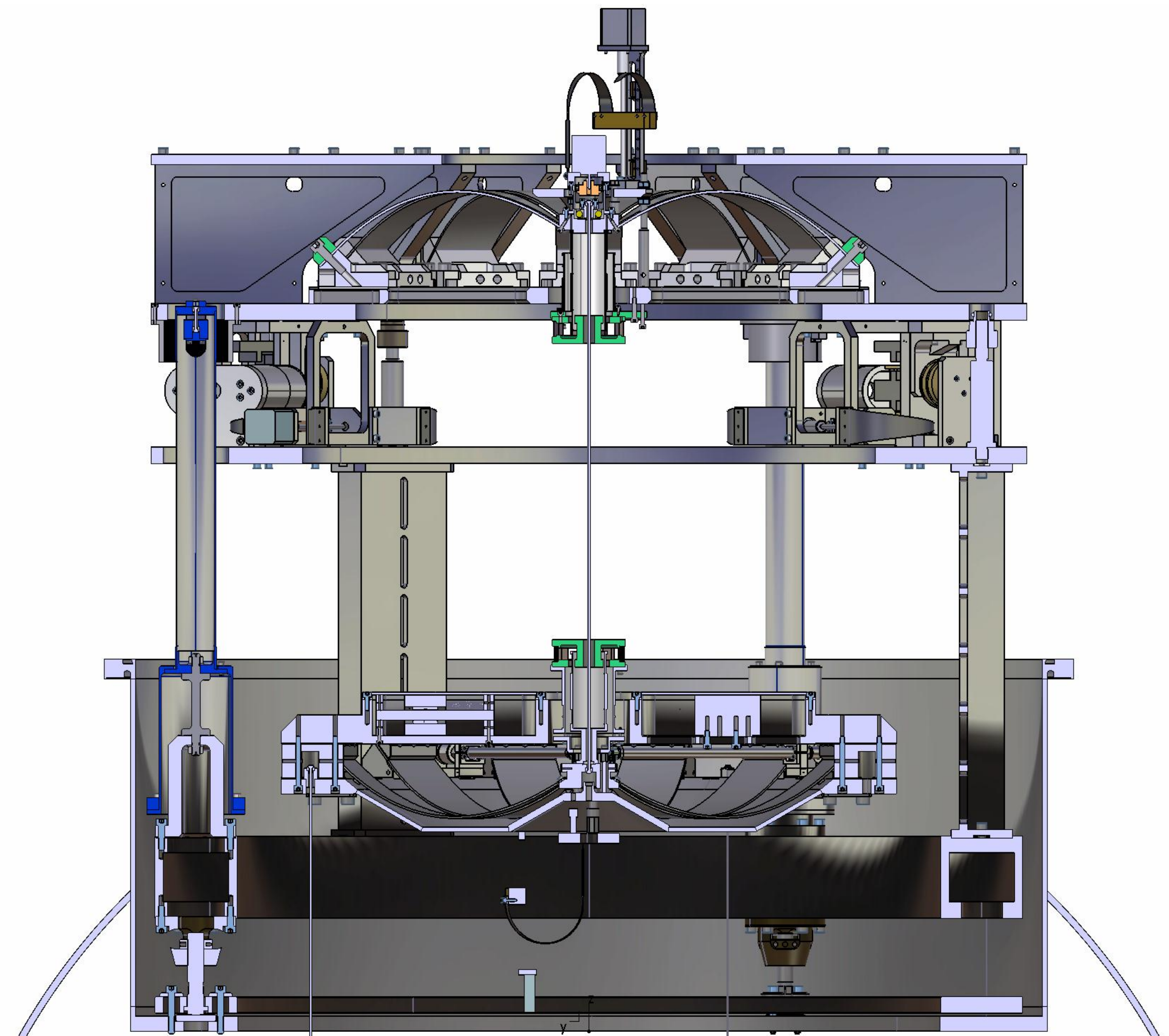
- Horizontal isolation
  - Inverted pendulum
  - Single wire suspension
  - Triple wire suspension
- Vertical isolation
  - Top GAS filter
  - Bottom GAS filter
- Inertial damping
  - From top GAS
- Bench control
  - From ground
  - Confirm performance

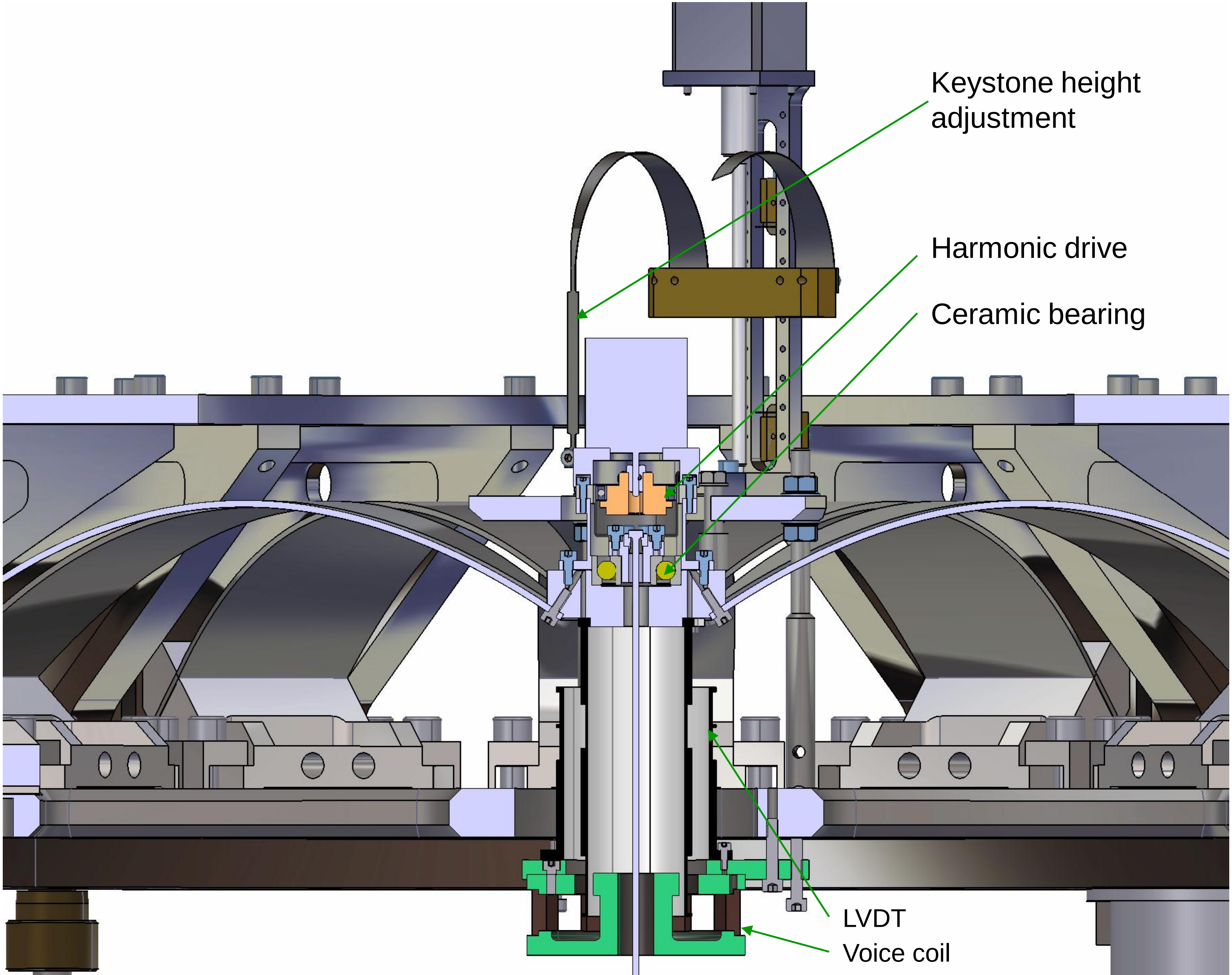


Dimensions and weights

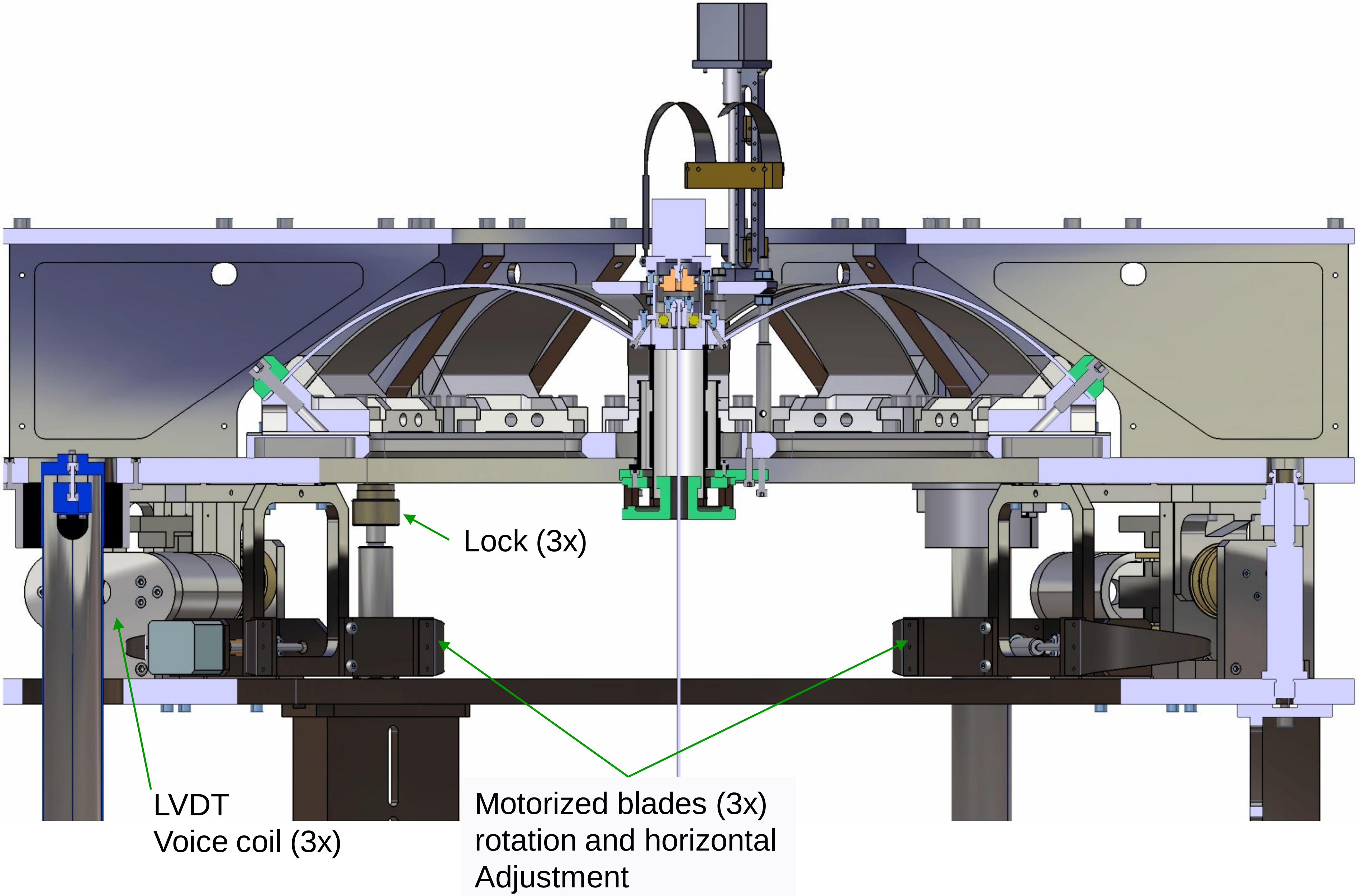


Cross section



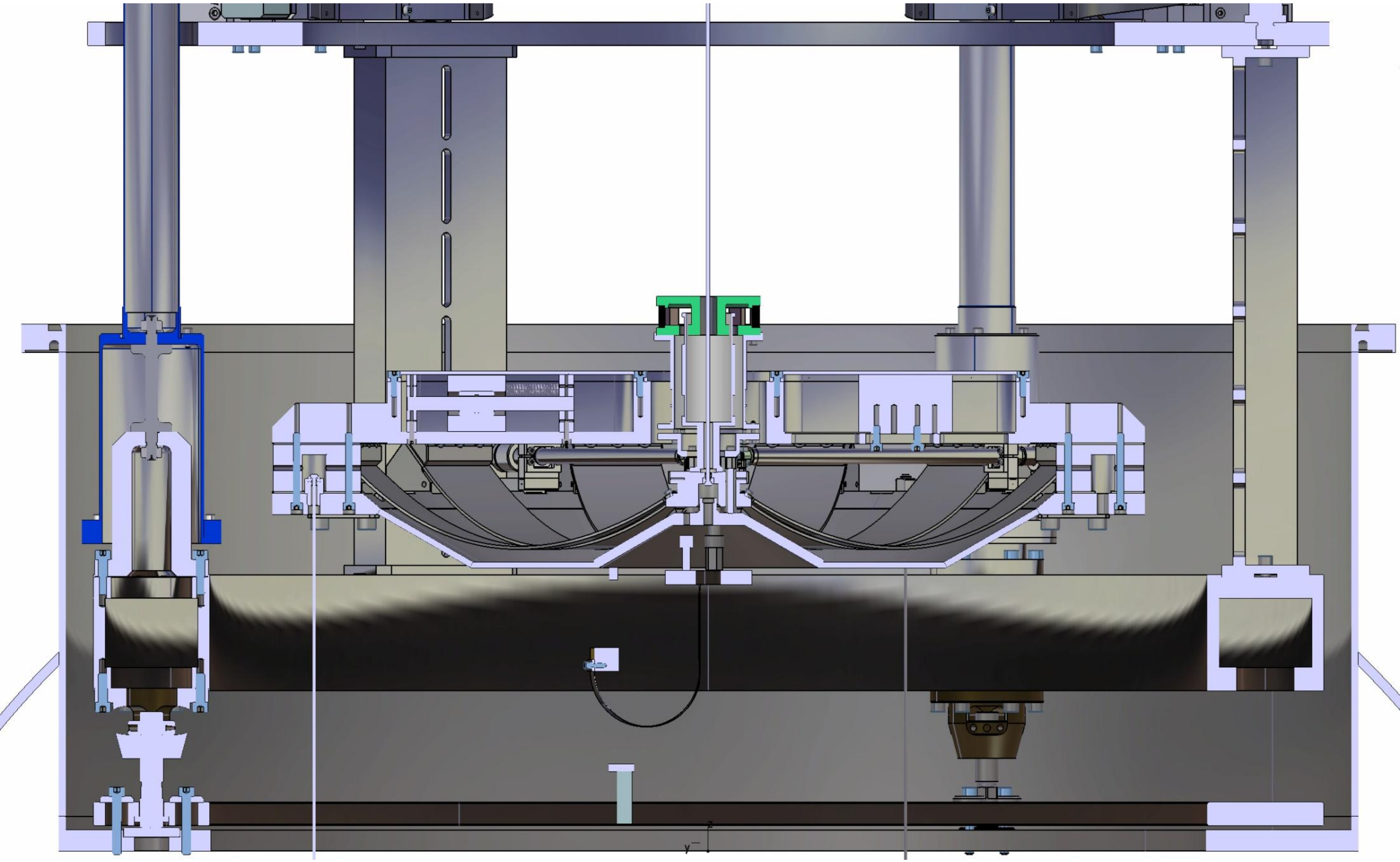

Keystone height adjustment
Harmonic drive
Ceramic bearing
LVDT
Voice coil

Top stage

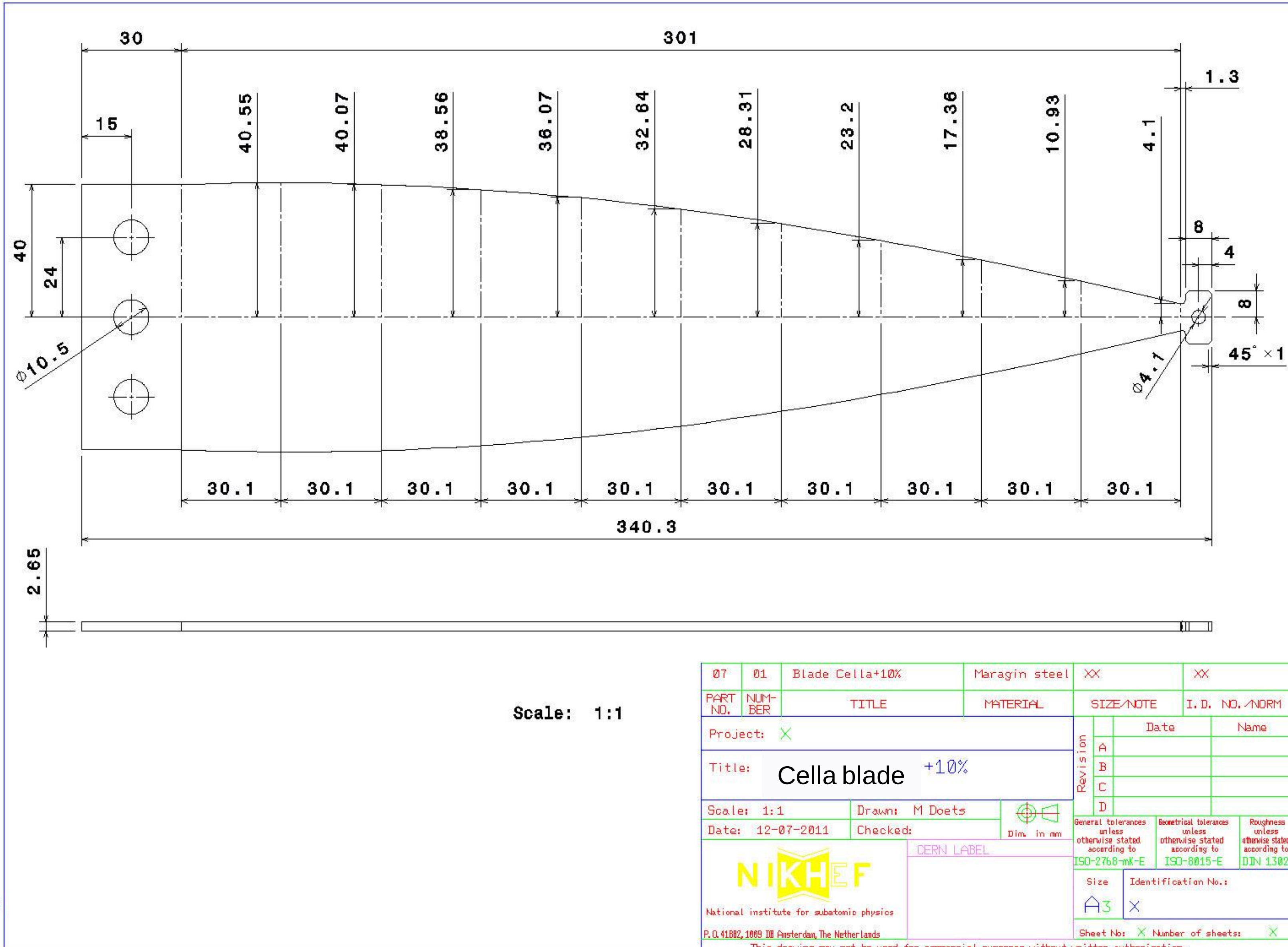


Lock (3x)
LVDT
Voice coil (3x)
Motorized blades (3x)
rotation and horizontal
Adjustment

Bottom stage



GAS BLADE DESIGN (PRELIMINARY)



Performance studies

Preliminary

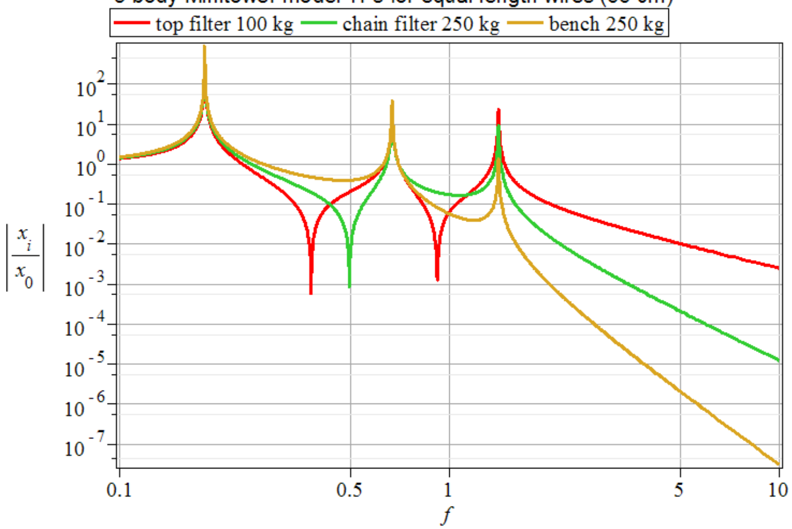
Specs of all models in this paper:

- IP-mode tuned at 200 mHz
- IP top plate including filter has mass 100 kg
- **3-body** system: 1=top filter, 2=chain filter, 3=bench (chain filter including marionette function)
- **4-body** system: 1=top filter, 2=chain filter, 3=marionette, 4= bench
- Total suspended mass $m_{sus}=m_2 + m_3$ $(+m_4)$ = 500 kg (= top filter maximum load)
- Bench mass 250 kg unless otherwise specified
- Total wire length $L_{tot} = L_1 + L_2$ $(+ L_3)$ = 200 cm
- Wires infinitely flexible
- Only 3 (4) rigid body horizontal modes considered
- Transfer functions plotted with bandwidth 1 mHz for all modes.
- Created using Maple

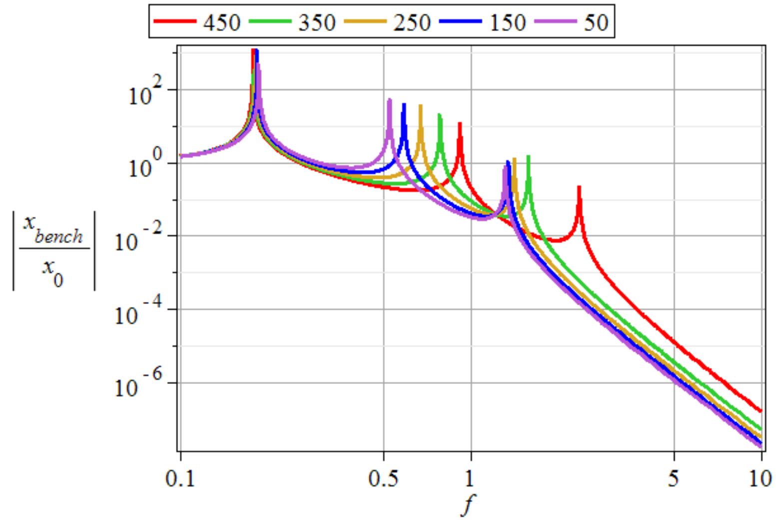
3 – BODY STUDIES

Preliminary

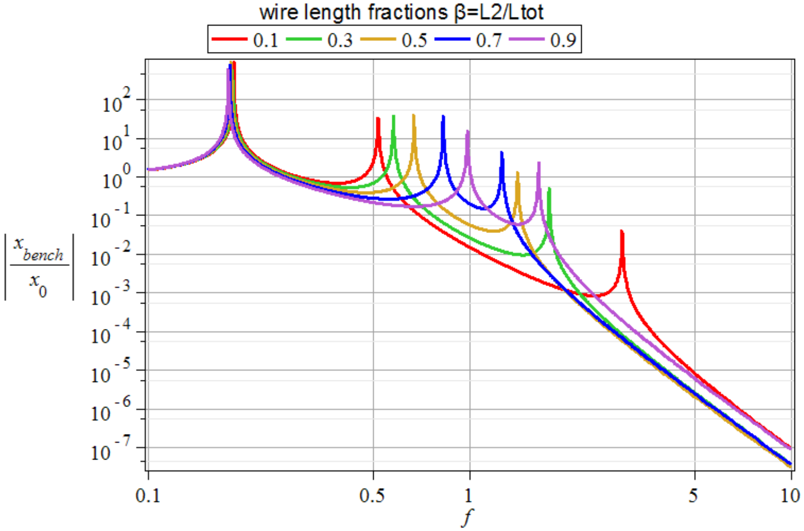
3 body Minitower model TFs for equal length wires (66 cm)



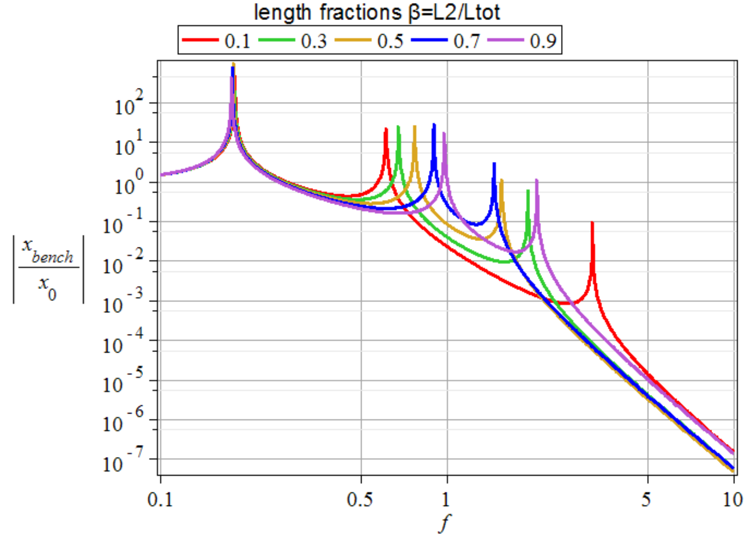
3 body minitower bench TF, equal wire lengths (β=0.5) and varying bench masses



3-body minitower bench TF, equal suspended masses(250 kg each), varying filter wire length fractions β=L2/Ltot

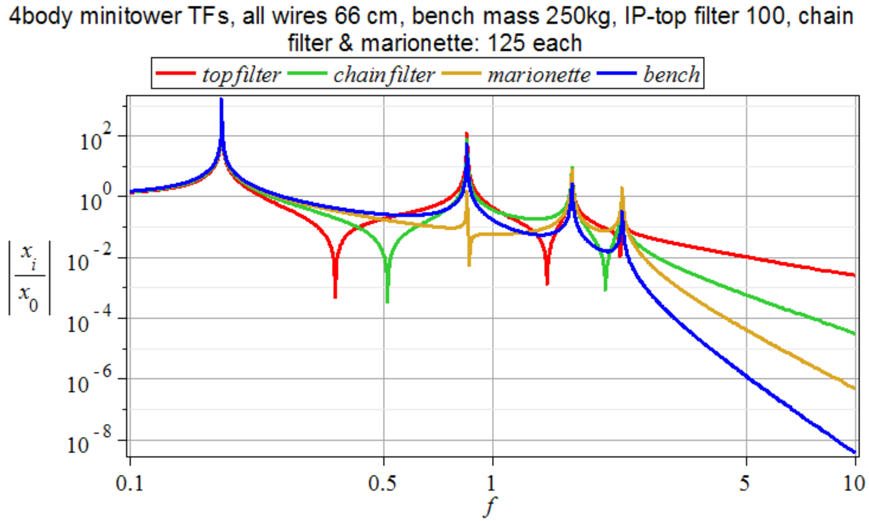


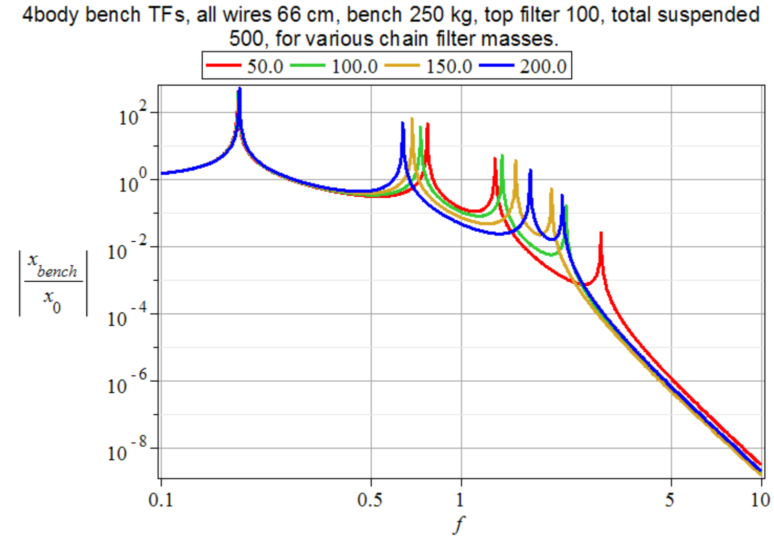
3-body minitower bench TF, bench mass 340 kg and varying filter wire length fractions β=L2/Ltot

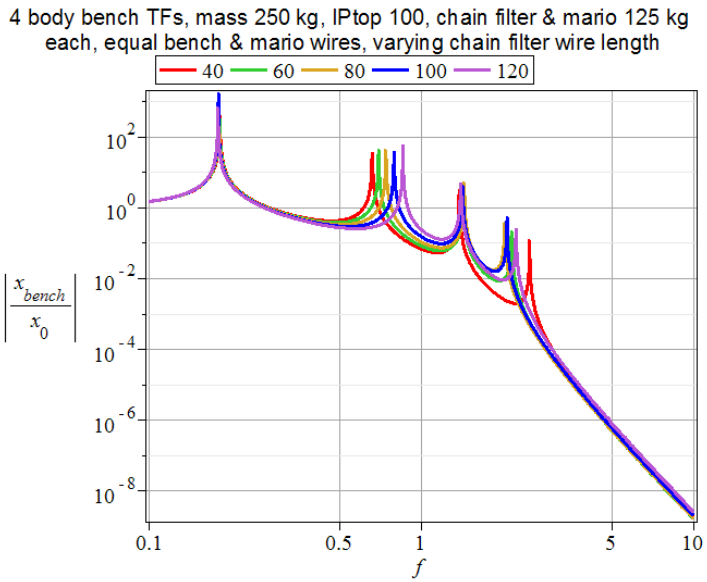


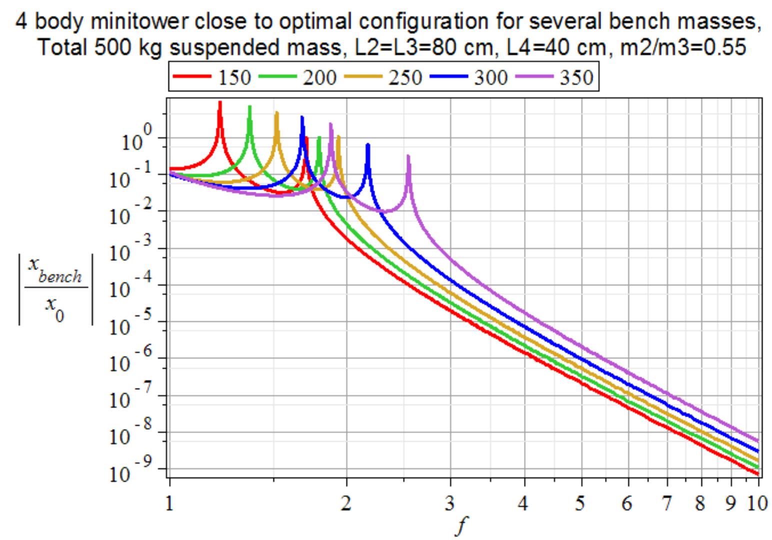
4 – BODY STUDIES

Preliminary





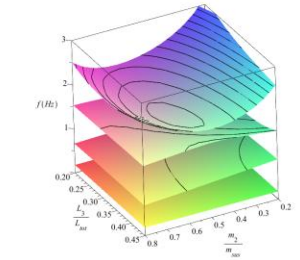




Performance studies

Preliminary

4-body modal frequencies; fixed filter wire length L2=84cm (β2= 0.42), varying filter mass and mario wire length



Conclusion: optimal configurations (= lowest TF @ 10 Hz)

For ~ 350 kg bench:

3 body:

L_2=140 cm , L_{bench}=60 cm
f_4 =1.45 Hz (modal)
TF_{bench} = 5e-8 @ 10 Hz

4-body:
m_2= 82 kg , m_3= 67 kg,
L_2=60 cm , L_3=70 cm , L_{bench}=50 cm
f_4 =2.55 Hz (modal)
TF_{bench} = 5e-9 @ 10 Hz

For ~ 250 kg bench:

3 body:

L_2=80-120 cm , L_{bench}=120-80 cm
f_4 =1.3-1.5 Hz (modal)
TF_{bench} = 3e-8 @ 10 Hz

4-body:
m_2= 137 kg , m_3= 113 kg ,
L_2=70 cm , L_3=70 cm , L_{bench}=60 cm
f_4 =2 Hz (modal)
TF_{bench} = 1.5e-9 @ 10 Hz

Displacement noise well below 10^{-12} m/rtHz at 10 Hz

Logistics

- Issues
  - Design in progress
    - Mechanics
    - Simulations
    - Accelerometers, LVDTs, actuators, stepping motors
    - Experience with EIB-SAS
  - Interface with mini-tower
    - IP support ring (specify tilt requirements)
    - Controls from ground: performance
- Prepare prototype
  - Construction H2 2011
  - Test H1 2012
    - Vacuum vessel needed
    - Specify tests
- Cost estimate

QUESTIONS

- Beam spot motion
  - Spot movement on QPD
    - Acceptable?
- RMS movement
  - Low frequency cut-off control signals from QPD?

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- Angular requirement
  - Sensitivity of telecope?

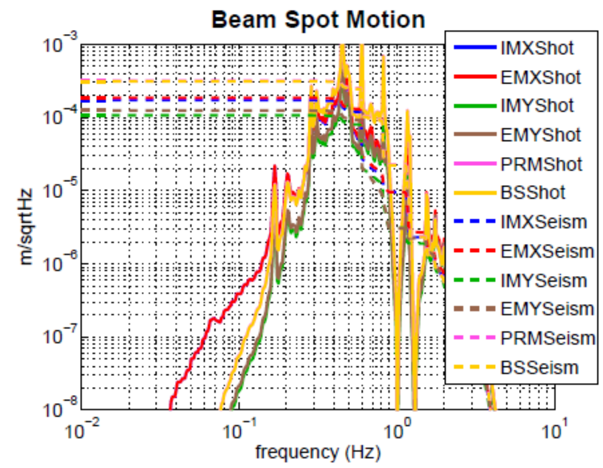

Figure 10: Beam spot motion on the optics.

Automatic Alignment Sensing and Control scheme for Advanced Virgo MSRC configuration

VIR-0201A-11

M. Mantovani

Issue: 1

Date: April 18, 2011

	Requirement (330μm beam)
δh	1.1e-11 m/sqrt(Hz)
δθ	1.5e-14 rad/sqrt(Hz)
h_{RMS}	6.4e-7 m
θ_{RMS}	9e-10 rad

	Requirement (1650μm beam)
δh	5.4e-11 m/sqrt(Hz)
δθ	7.6e-14 rad/sqrt(Hz)
h_{RMS}	3.2e-6 m
θ_{RMS}	4.4e-9 rad